02720 – STORM DRAINAGE

(Revised 09/15/03)

SELECTED LINKS TO SECTIONS WITHIN THIS SPECIFICATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this specification.

B. Section 01000 – GENERAL REQUIREMENTS.

C. Section 02220 – TRENCHING, BACKFILLING, AND COMPACTION OF UTILITIES.

D. Section 02730 – SANITARY SEWER.

E. Any Specifications or details not covered herein shall be per Virginia Department of Transportation, *Road and Bridge Specifications*, 2002 or latest revision.

1.2 SUMMARY

This section includes all equipment, labor, material, appurtenances, and services required for complete installation of storm drainage piping, ditches, structures, and specialties for municipal drainage systems.

1.3 DEFINITIONS

For the purposes of this specification, the following definitions refer to storm water drainage systems and structures that come under the authority of the City of Lynchburg, Virginia as specified within this section and other sections of this manual.

Public Storm Drainage System: Drainage systems and their appurtenances required for the conveyance of public storm water from and across publicly maintained streets, roads, highways, and other public property and located within public rights-of-way and/or easements.

1.4 SUBMITTALS

A. Submit shop drawings on all non-standard products/materials.

B. Submit product data and shop drawings for the following in accordance with Section 01000*, General Requirements*.

1) Drop/curb inlets
2) Frame and covers
3) Head/end walls
4) Inlet grates
5) Pipe and piping specialties
6) Precast concrete manhole castings

1.5 QUALITY ASSURANCE

A. Materials and operations shall comply with the latest revision of all applicable Codes and Standards.

B. Piping materials shall be marked clearly and legibly.

1) Reinforced Concrete Pipe shall be marked as follows:

a. Pipe Class,
b. Manufacturer

2) Plain Concrete Pipe shall be marked as follows:

a. Pipe Class,
b. Manufacturer

3) Ductile Iron Pipe shall show identification marks on or near bell as follows:

a. Weight,
b. Class or nominal thickness,
c. The letters “DI” or “Ductile,”
d. Manufacturer’s identifying mark,
e. Year in which pipe was made,
f. Casting period.

1.6 STANDARD ABBREVIATIONS

AASHTO	American Association of State Highway Transportation Officials
ACI	American Concrete Institute
ACPA	American Concrete Pipe Association
ANSI	American National Standards Institute

AREA	American Railway Engineers Association
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
CRSI	Concrete Reinforcing Steel Institute
DIP	Ductile Iron Pipe
FS	Federal Specifications
MSDS	Material Safety Data Sheets
NCMA	National Concrete Masonry Association
OSHA	Occupational Safety and Health Administration
PCP	Plain Concrete Pipe
RCP	Reinforced Concrete Pipe
VDOT	Virginia Department of Transportation

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. **Pipe Condition/Pipe Examination**

1) **New Pipe Inspection**: Inspect materials thoroughly upon arrival. Examine materials for damage. Remove damaged or rejected materials from site. Pipe shall be protected during handling against impact shocks and free fall. Pipe shall be kept clean at all times, and no pipe shall be used in the work that does not conform to the appropriate ASTM Specifications. Check bells and spigots closely for smoothness, roundness, and honeycombing (concrete pipe), which may be a source of infiltration. Check for cracks, chips, etc. on both ends. Reject any pipe that will not provide watertight seal or is otherwise structurally deficient.

2) **Pre-Installation Inspection**: Prior to being installed, each section of the pipe shall be carefully examined for damage and conformity with these specifications. All pipe damaged or deemed not to conform to these specifications shall be rejected and removed from site. All pipe in which the spigots and bells cannot be made to fit properly, or pipe, which has chipped bells or spigots, will be rejected. The faces of all spigots ends and of all shoulders on the bells must be true.

B. Protect pipe coating during handling using methods recommended by the manufacturer. Use of bare cables, chains, hooks, metal bars, or narrow skids in contact with coated pipe is not permitted.

C. Observe manufacturer's directions for delivery and storage of materials and accessories.

D. Protect stored piping from entry of water or dirt into pipe. Protect bells and flanges of special fittings from entry of moisture and dirt.

E. Handle precast concrete manholes and other structures according to manufacturer's written rigging instructions.

1.8 COORDINATION

Coordinate tie-in to municipal drainage systems with the City of Lynchburg City Engineer.

PART 2 – PRODUCTS

2.1 PIPE & FITTINGS

2.1.1 DUCTILE IRON PIPE

A. **Ductile Iron Pipe**

Ductile iron pipe shall be manufactured in accordance with all applicable requirements of AWWA C151/ANSI A21.51 and ASTM A746, *Standard Specification for Ductile Iron Gravity Sewer Pipe* for 4-inch and larger diameter pipe, thickness class rated, class 50 minimum. The thickness of Ductile Iron Pipe shall be determined by considering trench load in accordance with ANSI/AWWA C150/A21.50. Minimum laying length shall be 18 feet except for tie-in at a structure.

The ductile iron pipe shall be cement mortar lined with a seal coat in accordance with ANSI/AWWA C104/21.4. Outside coat shall be a minimum of 1 mil bituminous paint according to ANSI/AWWA C151/A21.21 Section 51-8.1.

Push-on and mechanical joint pipe shall be as manufactured by the American Cast Iron Pipe Company, United States Pipe and Foundry Company, Griffin Pipe Products Company, or McWane Cast Iron Pipe Company.

B. **Ductile Iron Joints**

Pipe joints may be either push-on or mechanical joint pipe sizes 4 inches through 48 inches in diameter. Rubber Gasket Joints and Mechanical Joints shall comply with AWWA C111/ANSI A21.11, ASTM A536 *Standard Specification for Ductile Iron Castings*. Acceptable pipe joints are as follows:

1) **Push-on Joint** Ductile Iron Pipe shall conform to AWWA C151/ANSI A21.51 (such as *"Fastite," "Tyton,"* or *"Bell-Tite."*). The dimensions of the bell, socket, and plain end shall be in accordance with the manufacturer's standard design dimensions and tolerances. The gasket shall be of such size and shape to provide an adequate compressive force against the plain end and socket after assembly to affect a positive seal. Gaskets shall be vulcanized natural or vulcanized synthetic rubber, and comply with AWWA C111/ANSI A21.11.

2) **Mechanical Joint, Ductile Iron Pipe** shall be used only at the specific locations indicated on the drawings or as approved by the City Engineer.

a. The mechanical joint shall consist of:

i. A bell cast integrally with the pipe or fitting and provided with an exterior flange having cored or drilled bolt holes and interior annular recesses for the sealing gasket and the spigot of the pipe or fitting;

ii. A pipe or fitting spigot;

iii. A sealing gasket;

iv. Separate ductile iron follower gland having cored or drilled bolt holes; and

v. Ductile iron tee head bolts and hexagon nuts.

b. The joint shall be designed to permit normal expansion, contraction, and deflection of the pipe or fitting while maintaining a leak proof joint connection. The mechanical joint shall conform to the requirements of Federal Specification WW-P-421, AWWA C111/ANSI A21.11, and ASTM A 536 Standard Specification of Ductile Iron Castings.

2.1.2 PLAIN CONCRETE PIPE

PCP shall be a minimum of Class III, Wall B. Concrete pipe joints shall be tongue and groove type unless otherwise specified. PCP pipe shall conform to the requirements of applicable sections of the latest revisions of the VDOT Road and Bridge Specifications.

PCP shall also meet ASTM C14, *Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe,* Extra Strength.

Gasketed Joints in Concrete Pipe shall meet ASTM C990, *Standard Specification for Joints in Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants*, latest revision.

2.1.3 REINFORCED CONCRETE PIPE

RCP shall be a minimum of Class III, Wall B. Concrete pipe joints shall be tongue and groove type unless otherwise specified. RCP shall conform to the requirements of applicable sections of the latest revision of the VDOT *Road and Bridge Specifications*.

RCP Class III or IV shall also meet ASTM C76*, Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe*.

Gasketed Joints in Concrete Pipe shall meet ASTM C990, *Standard Specification for Joints in Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants*, latest revision.

2.2 MISCELLANEOUS APPURTENANCES

2.2.1 BEDDING

See Section 02220, *Trenching, Backfilling, and Compaction of Utilities*.

2.2.2 CONCRETE BLOCK

Concrete block shall conform to the requirements of ASTM C139, *Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes*.

2.2.3 BRICK

Brick shall be hard clay, grade SM, ASTM C 32, *Standard Specification for Sewer and Manhole Brick (Made From Clay or Shale)* and AASHTO M91.

2.2.4 MORTAR FOR CONCRETE BLOCK & BRICK

Mortar shall be type M, ASTM C 270, *Standard Specification for Mortar for Unit Masonry* and ASTM C 144, *Standard Specification for Aggregate for Masonry Mortar.* Mortar shall be prepared from cement in perfect condition and shall be prepared in boxes for that purpose. No mortar that has stood beyond forty-five minutes shall be used. Proportion by volume for the different types of application shall be as follows:

Brick masonry = 1 part cement to 2 parts sand

Pointing = 1 part cement to 1 part sand

2.2.5 MISCELLANEOUS CONCRETE

Concrete Classes (VDOT) to Design Compressive Strength at 28 days (f'c):

Class A4.5	General	4,500-psi
Class A4	General	4,000-psi
Class A3	General	3,000-psi
Class B2	Massive or Lightly Reinforced	2,200-psi

Ready mixed concrete shall comply with ASTM C94, *Standard Specification for Ready-Mixed Concrete.* All exposed concrete shall be air entrained. Concrete strength shall be as specified on standard details and drawings. Unless otherwise specified, all concrete shall be Class A3, minimum.

2.2.6 PORTLAND CEMENT

Type I, CSA normal, ASTM C150 *Standard Specification for Portland Cement*.

2.2.7 PRECAST REINFORCED CONCRETE STRUCTURES

Manholes of precast reinforced concrete shall be designed and manufactured in accordance with ASTM C478, *Standard Specification for Precast Reinforced Concrete Manhole Sections*, or latest revision. Manhole diameters shall be 4-foot minimum. The wall shall be a minimum of 5 inches thick and have a 6-inch minimum base. Manholes shall be of precast concrete manhole risers with a tongue and groove joint and a monolithic precast bottom, except where doghouse bases are to be used when placing manholes over existing mains. Joints shall be sealed with a minimum of butile mastic in conformance with AASHTO M 198, latest revision.

Manhole steps are not permitted.

Unless otherwise approved by the City Engineer, manholes will be precast reinforced concrete.

Manholes over 12 feet in depth, as measured from top of casting to effluent invert, shall have extended bases with appropriate reinforcing.

2.2.8 MANHOLE FRAMES AND COVERS

Standard Frames and Covers: Manhole frames and covers shall be manufactured from Class 30 gray iron, meeting the requirements of ASTM A48*, Standard Specification for Gray Iron Castings*. Standard manhole frames and covers shall be manufactured to the dimensions and configurations shown on **Standard Details 27.10 and 27.11** and shall have a minimum of 4 1-inch diameter holes in the flange of the frame. Minimum inside diameter of the opening shall be 24 inches. Manholes castings may be either bituminous coated or plain. The bearing surface of the frames and covers shall be machined and the cover shall seat firmly into the frame without rocking. Covers are to be embossed along the perimeter with the words “Storm.” Approved castings are the US Foundry 710 ring and DP cover, East Jordan Iron Works 2027 frame and cover, or approved equal. (See **Standard Details 27.10 & 27.11**). All castings are to be USA made.

A Vulcan V-1883 is to be used with flat top manholes.

2.2.9 DROP INLETS

A. Drop inlet tops shall be precast and shall conform to the requirements of all applicable sections of the latest revision of VDOT *Road and Bridge Specifications and Standards*.

B. Drop inlet bases shall be precast and shall conform to the requirements of all applicable sections of the latest revisions of the VDOT *Road and Bridge Specifications and Standards*.

C. Unless otherwise approved by the City Engineer, all drop inlet tops and bases will be precast reinforced concrete.

D. Inlet Grates shall conform to the requirements of all applicable sections of the latest revision of the VDOT *Road and Bridge Specifications and Standards*.

2.2.10 MISCELLANEOUS STORMWATER APPURTENANCES

All miscellaneous stormwater appurtenances including but not limited to endwalls, headwalls, and flared end sections shall conform to all applicable sections of the latest revision of VDOT *Road and Bridge Specifications and Standards*.

PART 3 – EXECUTION

3.1 PIPE INSTALLATION - GENERAL

3.1.1 CONSTRUCTION – ALL PIPE

A. **Trench Width**: Trench width shall be per **Standard Detail 27.01.**

B. **Minimum Bury Requirements**: Minimum cover shall be in accordance with manufacturer's recommendations.

C. **Pipe Laying Direction**: Place piping beginning at low point and progress uphill. Place on grade, with unbroken continuity in invert, horizontally and vertically, and on alignment as indicated on plans. Place bell ends of piping facing upstream. Install gaskets, seals, sleeve, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

D. **Directional Changes in Gravity Lines**: Use manholes for changes in direction of gravity lines.

E. **Stringing out Pipe**: When pipe is strung out during unloading, it shall be set on high ground and in a position to prevent silt deposits, storm water, or other matter from entering the pipe prior to its placement in the trench.

F. **Pipe Laying**: Pipe shall be bedded per Section 02220 – *Trenching, Backfilling and Compaction of Utilities*. The pipe and fittings shall be laid in the trench so that its interior surface shall conform to the grade and alignment as shown on the plans. Pipe laying shall be done in such a way as to disturb as little as possible the pipe that has already been laid. The alignment and grade of the storm main may be field adjusted whenever, in the opinion of the City Engineer, it is necessary, so long as the changes are consistent with the City of Lynchburg policy in affect at the time of the change. Changes in either grade or alignment may only occur at manholes.

Before laying, the bell and spigot will be wiped free from any dirt or other foreign matter. All surfaces of the portion of the pipe to be joined, and the factory-made jointing material, shall be clean and dry. Jointing material shall be used as recommended by the pipe or joint manufacturer's specifications. The jointing material or factory-fabricated joints shall then be placed, fitted, and adjusted in such workmanlike manner as to obtain the degrees of water tightness required.

Trenches shall be kept as dry as possible during bedding, laying and jointing and for as long a period as required until the trench is backfilled. As soon as possible after the joint is made, sufficient backfill material shall be placed along each side of the pipe to offset conditions that might tend to move the pipe off line or grade.

The greatest care shall be used to secure water tightness and to prevent damage to or disturbing of the joints during the backfilling process, or at any other time.

After the trench foundation has been properly graded to receive the pipe, the pipe shall be carefully lowered into the trench with approved methods. Under no circumstances shall the pipe or accessories be dropped or dumped into the trench. All damaged pipe shall be replaced at the Contractor's expense.

At least 4 joints shall be left exposed for inspection purposes during the working day and a suitable ladder affording easy and safe access for such inspection shall be furnished.

Any defects due to settlement shall be made good by the Contractor at his own expense.

G. **Temporary Suspension of Work**: When the trench is left for the night or if pipe laying is suspended, the upper end of the pipe shall be plugged to keep out dirt, water, animals and other foreign matter or substances. This plug shall be kept in the end of the pipe line at all times when laying is not in actual progress.

H. **Cutting or Fitting Pipe**: Whenever a pipe requires cutting to bring a pipe to the required location, the work shall be done in a satisfactory manner with an approved cutting tool or tools which will leave a smooth end at right angles to the axis of the pipe and not otherwise damage the pipe. The method of cutting pipe shall be in accordance with manufacturer's recommendations. Such cuts shall be made by the Contractor without extra compensation.

3.1.2 DUCTILE IRON PIPE

A. Bury limitations shall govern as follows based on the type laying condition:

Table 27.1			
Bury Limitations on DIP			
Pipe	**Maximum Bury to Invert of Pipe[a]**		
	Type 2 Laying Condition – Equivalent to Class D Bedding	**Type 4 Laying Condition - Equivalent to Class C Bedding (See Detail 27.01)**	**Type 5 Laying Condition - Equivalent to Class B Bedding (See Detail 27.01)**
8-inch DIP, Class 50	20 feet	34 feet	50 feet
10-inch DIP, Class 50	15 feet	28 feet	45 feet
12-inch DIP, Class 50	15 feet	28 feet	44 feet
14-inch DIP, Class 50	14 feet	27 feet	44 feet
16-inch DIP, Class 50	15 feet	28 feet	44 feet

[a]Laying condition **Type 2** is a flat bottom trench with backfill lightly compacted to centerline of pipe (equivalent to Class D). Laying condition **Type 4** is a 4-inch bed of stone with pipe embedded to 1/8 pipe diameter (equivalent to Class C bedding). **Type 5** laying condition is also a 4-inch bed of stone with pipe embedded to the spring line of the pipe (equivalent to a Class B).

B. Ductile Iron Pipe is approved for all storm uses within City Right-of-Way/Easements.

3.1.3 REINFORCED CONCRETE PIPE

A. Pipe support for pipe shall provide uniform bearing for the pipe barrel along its entire length.

B. **Minimum Pipe Bedding Class**: See Section 02220*, Trenching, Backfilling and Compaction of Utilities*, paragraph 3.3.2 for minimum bedding requirements.

C. Pipe with varying wall class must not be mixed between manholes or boxes.

D. **Bury Limitations**: **Table 27.2** shall govern as the maximum allowable bury for concrete storm pipe:

Table 27.2

Bury Limitations on RCP (15 through 60 inches)

Pipe Class	Maximum Depth of Bury[a]			
	Class III (feet)	**Class IV** (feet)	**Class V** (feet)	**Max Trench Width** (feet)
15-inch	9.5	14.5	23.0	4.0
18-inch	9.5	15.0	32.5	4.0
24-inch	11.5	23.0	50.0	4.0
30-inch	11.0	19.5	44.5	5.0
36-inch	10.5	18.0	35.0	6.0
42-inch	11.0	19.0	36.5	6.5
48-inch	11.5	19.5	37.5	7.0
54-inch	12.0	20.0	38.5	7.5
60-inch	12.0	20.5	38.5	8.0

[a] Based on saturated clay weighing 120 pcf, trench width as specified, class C stone bedding, 1350 plf per ft of internal diameter for class III and 2000 plf per ft of internal diameter for class IV, 3000 plf per ft of internal diameter for class V, $D\text{-}_{0.01\ crack}$

E. Join concrete pipe using bitumastic material to seal joint.

F. As each joint is laid, visually inspect to be certain that no jointing compound gasket, or trash is protruding from the joint or lying inside the pipe.

3.1.4 PLAIN CONCRETE PIPE

A. Plain Concrete Pipe is approved for storm uses in non-traffic bearing situations only.

B. Pipe support for pipe shall provide uniform bearing for the pipe barrel along its entire length.

C. Minimum pipe bedding class: *see 3.1.3, paragraph B, above*.

D. Pipe with varying wall class must not be mixed between manholes or boxes.

E. **Bury Limitations**: *See **Table 27.3**, below*.

Table 27.3
Bury Limitations on PCP
(12 through 24 inches)

Pipe Diameter	Maximum Depth of Bury Non Reinforced (feet)
12-inch	9.5
15-inch	9.5
18-inch	10.5
21-inch	11.0
24-inch	11.5

F. Join concrete pipe using bitumastic material to seal joint.

G. As each joint is laid, visually inspect to be certain that no jointing compound, gasket, or trash is protruding from the joint or lying inside the pipe.

3.2 MANHOLE CONSTRUCTION FOR STANDARD MANHOLES AND DROP INLET BASES

A. **Standard Manholes and Drop Inlet Bases**: Manholes shall be constructed in accordance with **Standard Details 27.02** and **27.03** with the following exceptions:

Flexible boots and precast concrete inverts will not be required.

Joints will be as specified in the product section of this specification.

The pipe opening in precast units shall be at least 4 but not more than 8 inches larger than the outside diameter of the pipe. Pipe openings shall be formed, drilled, or neatly cut as approved by the Engineer.

The contractor may use brick and masonry block or concrete pipe cutoffs in conjunction with mortar to fill the void between pipe culverts and precast structures. Such materials shall be thoroughly wetted and bonded with mortar. The remaining exterior and interior void shall be filled and sealed/slicked with mortar to the contour of the precast structure.

The standard joint shall be sealed on the interior of the structure, after installation, with a non-shrink hydraulic cement mortar per VDOT *Road and Bridge Specifications*, Section 218.

Plug all weep holes with mortar.

Pour concrete inverts in all structures. Concrete shall be in compliance with products section for miscellaneous concrete of these specifications. Shape manhole channel with a smooth semicircular bottom matching inside diameter of the connecting pipe/pipes. Change directions of flow with a smooth curve of as large a radius as the manhole size will permit. Change size and grade of channels gradually and evenly. Shape the shelf to provide a slope between 1 and 2 inches per foot towards the invert.

Manholes shall be installed plumb.

B. **Grade Rings/Adjustments**: The contractor shall exercise care in the ordering of structures so that the use of grade rings or brick for leveling and adjustments can be minimized. Where adjustment of a manhole is required, grade rings shall be used unless otherwise approved by the City Engineer. Where adjustment of the inlet is required, the use of bricks or grade rings is approved, provided that the entire void between the flat-top and inlet is also filled with brick and mortar to uniformly distribute loading of the inlet. The combination of grade rings or depth of bricks shall not exceed 12 inches before removal of the cone or flat-top is necessary for adjustment.

On all storm manholes, a mastic joint material shall be placed between the frame and cover and the cone or grade ring.

When applicable, during the installation of manholes, if frame and cover is near or within wheel path in roadway, turn cone to place the frame out of wheel path.

C. **Replacement/Rehabilitation of Existing Manholes**

When a new manhole is necessary, the old manhole must be completely removed and a new precast manhole constructed in its place. Where the old manhole is of satisfactory quality, the Contractor will make connection thereto as directed by the City Engineer at no additional cost even if it is necessary to modify the bottom of the manhole to meet the new grade. Such extras are considered to be incidental to the manhole connection cost.

3.3 INLET CONSTRUCTION AND MISCELLANEOUS APPURTENANCES

Construct inlets, end walls, and other storm drainage items as detailed in the latest edition of the VDOT *Road and Bridge Specifications and Standards*.

Adjusting inlet tops and/or miscellaneous appurtenances shall follow same guidelines as prescribed in 3.2, *Manhole Construction for Standard Manholes and Drop Inlet Bases*, paragraph B. *Grade Rings/Adjustments*, above.

3.4 ABANDONING STORM LINES & MANHOLES

A. **Storm Lines**: When an existing storm line is designated to be abandoned in place, the low end of the line is to be plugged and lean concrete grout (flowable fill) pumped into the line until line is completely filled.

B. **Manholes**: When an existing manhole, either partially or wholly, is designated to be abandoned and the storm lines, either entering or exiting the manhole, have been abandoned according to the preceding paragraph, the upper portion of the manhole shall be removed to a minimum of 18 inches below the proposed finished grade, or as determined by the City Construction Coordinator, VDOT #57 stone dumped into the manhole, and the stone vibrated to consolidate the stone. The remainder of the fill between the top of the manhole and the finished subgrade is to be backfilled as follows. Where the manhole is located within a roadway right of way, backfill with VDOT # 57 Stone and consolidate. Outside roadway right of ways, filter fabric shall be placed over the stone, suitable material of a compactable nature shall be placed over the top of the manhole, and the material tamped.

3.5 SLOPE ANCHORS

All lines on slopes equal to or greater than 20% slope shall have concrete anchors placed around the pipe directly below the bell end of the line. The anchors shall be spaced every other joint unless otherwise shown on the plans and constructed to the dimensions shown in **Standard Detail 27.21**.

3.6 EXCAVATION OF DRAINAGE CHANNELS

A. Open storm drainage channels and ditches shall be graded and shaped in accordance with the elevations, slopes, widths, and lengths indicated on the plans. The outfall elevation of the new channels and ditches shall be graded to match the flow elevations of all existing or natural channels, unless indicated or specified otherwise.
B. The drainage channels shaped with fill materials shall be compacted within the limits and in accordance with the related backfill work specified elsewhere.

C. The drainage channels shall be prepared, seeded, and mulched in accordance with the related work specified elsewhere. Where indicated or specified, erosions control measures, such as temporary liners, rip rap, concrete, etc., shall be provided.

3.7 INSPECTION

Upon completion of entire pipe installation, the City Engineer may inspect the work in part or as a whole as will satisfy himself/herself that every portion of the contract has been faithfully carried out.

If, in the opinion of the City Engineer, a defect exists in the pipeline or its appurtenances, in some place not accessible except by uncovering, the City Engineer may order the line to be uncovered. If it is found that after the pipe has been uncovered at the order of the City Engineer, no defect exists or that the defects were not the fault of the contractor, then the expense so incurred by the contractor shall be borne by the City.

Flush all sand, dirt, and debris from the lines prior to inspection. Provide lights and mirrors and inspect lines in the presence of the Construction Coordinator.

Inspect the system for conformance with line and grades shown on the plans and provide record drawing measurements on record drawings.

Visual Inspection: All lines and manholes shall be visually inspected by the City of Lynchburg from every manhole by use of mirrors or television cameras. The lines shall exhibit a fully circular pattern when viewed from one manhole to the next. Lines, which do not exhibit a true and correct line and grade, have obstruction or structural defects, shall be corrected to meet these specifications and the barrel left clean for its entire length.

END OF SECTION 02720

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